

Indicator: Index of Overall Condition of the Nation's Coastal Waters (350)

The nation's coastal waters, which include estuaries, wetlands, coral reefs, mangrove forests, and upwelling areas, provide an important interface between land and sea, as well as between fresh water and saline environments. Coastal waters provide unique and critical habitats, spawning grounds, food, and shelter for fish, birds, and other wildlife. Coastal resources support 85 percent of waterfowl and other migratory birds in the nation, and estuaries support commercial and recreational activities that are vital to the nation's economy (EPA 2004).

This indicator is based on the National Coastal Condition Report, which provides a characterization of the overall condition of the nation's coastal waters (EPA 2004). It is based on five indices constructed from combined survey data: water quality, sediment quality, benthic condition, coastal habitat, and fish tissue contaminants. The water quality index is based on five sub-indicators that include dissolved oxygen, nutrients (nitrogen and phosphorous), chlorophyll *a*, and water clarity. The sediment quality index is based on sediment toxicity, sediment contaminant concentration, and total organic carbon (TOC). The benthic condition index includes measures of benthic community diversity and, in some regions, the presence of pollution-tolerant or pollution-intolerant organisms. The coastal habitat index is based on wetland loss data, except for the Great Lakes. The fish tissue index is based on levels of chemical contamination in certain fish and shellfish species.

The five indices were each assigned ratings on a scale of 1 (a low condition rating) to five (a high condition rating) for each of the nation's coastal regions. The numeric rating scale translates into low (<2), moderate (2-4) and high (>4). The five index ratings were averaged to create an overall score for each coastal region. Regional scores were averaged to create a national score. The percentage area of each region classified as high is based on the stations at which none of the five indices showed a score below high; the percentage classified as low is based on stations that had a poor rating for at least one index. The national average is based on the weighted average of the areas for each region.

Data for this indicator are based on probabilistic surveys conducted on each of these measures in all estuarine waters of the conterminous 48 states and Puerto Rico by the NCA. For the Great Lakes, available non-probabilistic data were used. Wetland loss data used in the coastal habitat index derives from special study by the National Wetland Inventory, and alternative measurement approaches were used for the Great Lakes, where assessments include amphibian abundance and diversity, wetland-dependent diversity and abundance, coastal wetland area by type, and the effects of water level fluctuations.

What the Data Show

On the whole, the nation's coastal waters are in moderate condition, as the majority of regions received scores ranging from 2 to 4 (Figure 350-1). Regions 2, 3, and 6 received low ratings (below 2).

Over the entire U.S., 35% of the coastal area excluding the Great Lakes received low condition scores (ranging from 21% in Region 10 to 55% in Region 9), while 21% received high scores (ranging from 4% in Region 3 to 31% in Region 4).

Indicator Limitations

- The coastal areas of Alaska and Hawaii have been sampled, but not yet assessed. Data are not available for the U.S. Virgin Islands and the Pacific territories.

- There is insufficient information to compare National Coastal Condition Reports I and II for trend data. In some cases, indicators were changed in NCCR II to improve the assessment. In addition, reference conditions for some of the indicators were modified to reflect regional differences.

Data Sources

The data source for this indicator is the National Coastal Condition Report II, U.S. Environmental Protection Agency, 2004.

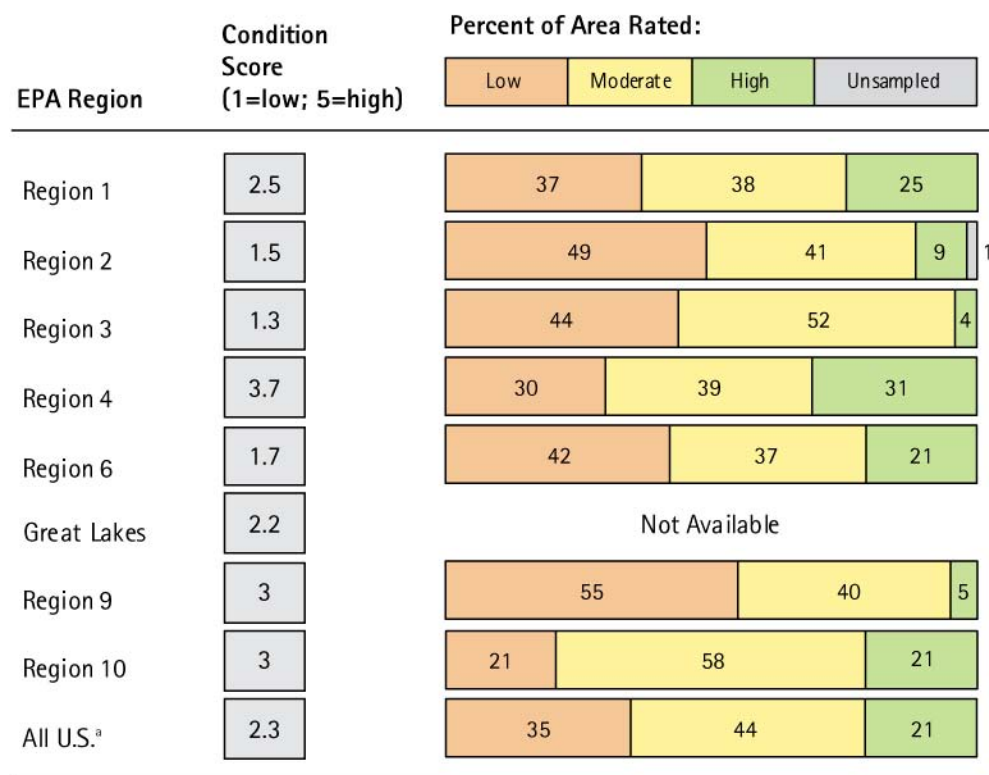
<http://www.epa.gov/owow/oceans/nccr/2005/downloads.html>

References

EPA. 2004. National Coastal Condition Report II, EPA-620/R-03/002. U.S. Environmental Protection Agency, Washington, DC.

Graphics

Figure 350-1: Summary of the US Overall Coastal Condition Based on Water Quality, Sediment Quality, Benthic, Coastal Habitat, and Fish Contaminant Indices^b



Source: National Coastal Condition Report II, US EPA, 2004.

Notes: ^a The national score is based on an aerially weighted mean of the regional scores.

^b The overall percentage is based on the overlap of the five indicators and includes estuarine area for all of the conterminous 48 states (by region and total) and Puerto Rico.

R.O.E. Indicator QA/QC

Data Set Name: COASTAL CONDITION INDEX

Indicator Number: 350 (113416)

Data Set Source: EPA/EMAP/NCA

Data Collection Date: 1999-2000

Data Collection Frequency: annually

Data Set Description: An indicator which combines the results of the individual assessment indicators into a summary for the geographic area of interest.

Primary ROE Question: What are the trends in extent and condition of coastal waters

Question/Response

T1Q1 Are the physical, chemical, or biological measurements upon which this indicator is based widely accepted as scientifically and technically valid?

Methods described for this survey represent a combination of standard, scientifically accepted sampling and analytical methodologies. They are described in ; US EPA 2001. National Coastal Assessment: Field Operations Manual. U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Gulf Ecology Division, Gulf Breeze, FL. EPA 620/R-01/003. pp72. U.S. EPA. 1995.

Environmental Monitoring and Assessment Program (EMAP): Laboratory Methods Manual- Estuaries, Volume 1: Biological and Physical Analyses. U.S. Environmental Protection Agency, Office of Research and Development , Narragansett, RI. EPA/620/R-95/008.

<http://www.epa.gov/emap/html/pubs/docs/groupdocs/estuary/index.html>

T1Q2 Is the sampling design and/or monitoring plan used to collect the data over time and space based on sound scientific principles?

There is an entire portion of the EMAP website dedicated to principles and implementation of the NCA monitoring design and analysis. <http://www.epa.gov/nheerl/arm/index.htm> Diaz-Ramos, S., Stevens, D.L., Jr and Olsen, A.R. (1996) EMAP Statistical Methods Manual. Rep. EPA/620/R-96/002, U.S. Environmental Protection Agency, Office of Research and Development, NHEERL-WED, Corvallis, Oregon. Olsen, A.R., Stevens, D.L., Jr. and White, D. (1998) Application of global grids in environmental sampling. Computing Science and Statistics, 30, 279-84. Stevens, D.L., Jr. (1997) Variable density grid-based sampling designs for continuous spatial populations. Environmetrics, 8, 167-95. Stevens, D.L., Jr. and Olsen, A.R. (1999) Spatially restricted surveys over time for aquatic resources. Journal of Agricultural, Biological, and Environmental Statistics, 4, 415-28. Stevens, D.L., Jr. and Urquhart, N.S. (1999) Response designs and support regions in sampling continuous domains. Environmetrics, 11, 13-41. Stevens, D. L., Jr. and Olsen, A. R. Variance Estimation for Spatially Balanced Samples of Environmental Resources. Environmetrics 14:593-610. Stevens, D. L., Jr. and A. R. Olsen (2004). "Spatially-balanced sampling of natural resources." Journal of American Statistical Association 99(465): 262-278.

T1Q3 Is the conceptual model used to transform these measurements into an indicator widely accepted as a scientifically sound representation of the phenomenon it indicates?

The five assessment indicators used by NCA were combined into a single indicator in response to the requirements of section 305(b) of the CWA. National indicators were created by calculating a weighted average of each of the five separate indicators. The indicators are weighted by the

percentage of total area of estuaries contributed by each geographic area. The overall national score was calculated by summing each national indicator score and dividing by five.

T2Q1 To what extent is the indicator sampling design and monitoring plan appropriate for answering the relevant question in the ROE?

Sampling for the indicator presents available information on a national scale for the conterminous 48 states and Puerto Rico. There are 50 sites sampled each year for each of the states or territory. Data collection began in 1999 and is ongoing in 2004.

T2Q2 To what extent does the sampling design represent sensitive populations or ecosystems?

Sensitive populations or ecosystems are represented to a limited extent. The monitoring design at the scale presented is to characterize condition on a regional scale, not specific areas.

T2Q3 Are there established reference points, thresholds or ranges of values for this indicator that unambiguously reflect the state of the environment?

Regional overall condition was calculated by summing the scores from each of available indicators and dividing by the number of indicators used. Numerical scores (1-5) were assigned based on the rating given to each indicator for the region, with the lower numbers representing a lesser condition value. Regional scores were then aerielly weighted to calculate the value for overall national condition.

T3Q1 What documentation clearly and completely describes the underlying sampling and analytical procedures used?

U.S. EPA. 1995. Environmental Monitoring and Assessment Program (EMAP): Laboratory Methods Manual-Estuaries, Volume 1: Biological and Physical Analyses. U.S. Environmental Protection Agency, Office of Research and Development , Narragansett, RI. EPA/620/R-95/008. U.S. EPA. 2001. Environmental Monitoring and Assessment Program (EMAP): National Coastal Assessment Quality Assurance Project Plan. . U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Gulf Ecology Division, Gulf Breeze, FL. EPA/620/R-01/002. U.S. EPA. 2001. National Coastal Assessment Field Operations Manual. U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Gulf Ecology Division, Gulf Breeze, FL. EPA/620/R-01/003.
<http://www.epa.gov/emap/html/pubs/docs/groupdocs/estuary/index.html>

T3Q2 Is the complete data set accessible, including metadata, data-dictionaries and embedded definitions or are there confidentiality issues that may limit accessibility to the complete data set?

<http://www.epa.gov/emap/nca/html/data/index.html> Stephen Hale, U.S. EPA, Atlantic Ecology Division, (401) 782-3048

T3Q3 Are the descriptions of the study or survey design clear, complete and sufficient to enable the study or survey to be reproduced?

Yes, Using the documentation provided for the design can be reproduced by a competent statistician. All of the field sampling and analytical methods are also well documented.

T3Q4 To what extent are the procedures for quality assurance and quality control of the data documented and accessible?

U.S. EPA. 2001. Environmental Monitoring and Assessment Program (EMAP): National Coastal Assessment Quality Assurance Project Plan. . U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Gulf Ecology Division, Gulf Breeze, FL. EPA/620/R-01/002 Hale, S., J. Rosen, D. Scott, J. Paul, and M. Hughes. 1999. EMAP Information Management Plan: 1998-2001. U.S. Environmental Protection Agency, Office of Research and Development , Narragansett, RI.
<http://www.epa.gov/emap/html/pubs/docs/groupdocs/estuary/index.html>

T4Q1 Have appropriate statistical methods been used to generalize or portray data beyond the time or spatial locations where measurements were made (e.g., statistical survey inference, no generalization is possible)?

Not Applicable

T4Q2 Are uncertainty measurements or estimates available for the indicator and/or the underlying data set?

Uncertainty has been established by each of the indicators that were summarized to generate the overall condition indicator. Additional calculations cannot be performed.

T4Q3 Do the uncertainty and variability impact the conclusions that can be inferred from the data and the utility of the indicator?

Inconsistency in application of the design, sample collection, or sample analysis. These are controlled through standardization of methodologies, publication of operational manuals, and training of personnel involved. It is monitored through quality assurance requirements and audits.

T4Q4 Are there limitations, or gaps in the data that may mislead a user about fundamental trends in the indicator over space or time period for which data are available?

The survey design dealt with data limitations and gaps at the level of each individual assessment